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Biology

BL01 - The Diversity of Living Organisms
Mark scheme

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Question	Marking guidance	Mark	Comments
01.1	A Capsule; B Cell wall; C Cell membrane/cell-surface membrane;	3	Ignore slime Reject capsid Ignore correct material for wall (e.g. murein) Reject cellulose in relation to cell wall Ignore plasma membrane
01.2	x 50 000;	1	Accept range between 48,000 and 52000
01.3	1.Chaperone proteins bind to hydrophobic groups (on the secretory proteins); 2. Prevent incorrect hydrophobic interactions; 3. Allows protein to be correctly folded;	2	Reference to hydrophobic required only once: Chaperone proteins bind to hydrophobic groups preventing incorrect interactions (2 marks) Chaperone proteins bind to groups preventing incorrect hydrophobic interactions (2 marks) Accept reference to folding into appropriate tertiary structure/3D shape/example of a correct structure
01.4	Bacteria do not have endoplasmic reticulum/chaperone proteins;	1	

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Question	Marking guidance	Mark	Comments
02.1	1. Molecule too large (to pass between membrane/phospholipid molecules); 2. Betanin charged/polar/hydrophilic/non-lipid soluble; 3. Shape does not fit through channel proteins/pores;	2 max	 Ignore any reference to water soluble Accept there are no carrier proteins for betanin
02.2	Any **four** from: 1. (as temperature increases) phospholipid/protein molecules gain kinetic energy and move more; 2. (as temperature increases) betanin molecules gain kinetic energy and move/diffuse faster; 3. (at higher temperatures) proteins (in the membrane) are denatured; 4. (and so) as temperature increases the permeability of the membrane increases/eventually becomes (fully) permeable; 5. Idea that betanin can move from the vacuole to the water when the membrane disrupted; 6. Idea the surface of the cells has been cut (and so betanin leaks out)	4 max	 Accept converse for lower temperatures throughout. Accept disrupts/breaks/damages the membrane
02.3	1. Keeps temperature constant / controls/maintains temperature; 2. Can be set at different temperatures;	1 max	Accept because room temperature fluctuates

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02.4	1. The membrane is destroyed/disrupted/denatured; 2. Maximum (amount of) pigment diffused into liquid; **OR** Concentration of pigment has reached equilibrium	2	Accept idea that membrane is already at 85°C Accept no further change in membrane above 85°C **OR** Accept idea that membrane is already fully permeable at 85°C

02.5	1. Idea of conditions the same except no beetroot sample/no betanin; 2. Boiled/cooked beetroot cubes (cooled and rinsed) (instead of fresh beetroot), (all other conditions the same);	1	Ignore no independent variable unqualified

02.6	1. Keep surface area to volume ratio the same/constant; 2. To ensure the only variable affecting rate of diffusion is temperature;	2	Accept idea of control for differences in surface area – i.e all have same surface area Accept so can compare one result with another

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Question	Marking guidance	Mark	Comments
03.1	To reduce/prevent bias;	1	Accept representative sample
03.2	(DNA in the mitochondria) 1. Shorter in length; 2. Circular; 3. Not associated with proteins/not in chromosomes; 4. Has no introns / has exons only	2	 Accept fewer genes/different sequencing in genes Accept smaller Accept loop of DNA Accept not associated with histones;
03.3	Mark in pairs: 1. The base sequence of mRNA (of the same gene); 2. The greater the number of differences in the (mRNA base) sequence, the greater the genetic diversity; **OR** 3. The amino acid sequence of an (encoded) protein; 4. The greater the number of differences in the (amino acid) sequence (of a protein), the greater the genetic diversity;	2	Must be marked in pairs Accept converse Accept converse Accept valid references to immuno comparison

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03.4	Any **one** from: 1. Develop (new) medicines/vaccinations/drugs to treat the disease/kill the flatworms; 2. Use the (current) most effective available medicine/drug to treat the (particular) flatworm causing the disease/to kill the (particular) flatworm causing the infection;	1	

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Question	Marking guidance	Mark	Comments
04.1	Bronchiole;	1	Ignore bronchus/trachea
04.2	Any **four** from: 1. Less elastic recoil; 2. Harder to remove air from the alveoli (when breathing out); 3. (More carbon dioxide/less oxygen in the alveoli) so reduced concentration gradients (for diffusion/gas exchange); 4. (The walls of the alveoli are damaged/broken down) so reduced surface area (for gas exchange); 5. Link (points 2 and/or 3) to reduced rates of diffusion in the right context; 6. (Inflammation of alveoli/thicker walls) so increased diffusion distance;	3 max	Accept less stretch (when breathing in)
04.3	Fibrous;	1	

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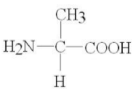
04.4	Any **two** from: 1. Idea of specific active site shape; 2. Only the proteins in the elastic tissue complementary shape (to active site); 3. Enzyme-substrate/E-S complexes **only** formed between protein in the elastic tissue and elastase;	2 max	 Accept active site tertiary/3D structure Accept idea of specific substrate shape Accept converse about other molecules Accept only the proteins in the elastic tissue fit shape of active site; Must be in context of other molecules not forming these Accept idea that only a specific substrate can bind

04.5		1	allow $^{+}H_3N$ instead of H_2N allow COO^{-} instead of COOH

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Question	Marking guidance	Mark	Comments
05.1	β/Beta glucose;	1	Accept b/B Reject any reference to alpha/α
05.2	1. Add Benedict's (reagent) and heat/warm; 2. Red/orange/yellow/green (colour);	2	Reject Add HCl Accept brown, reject other colours
05.3	1.0×10^{-3};	1	Accept 0.97×10^{-3} Accept 9.7×10^{-4}

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05.4	1. Line graph with rate on *y* axis and time in hours/days on x-axis and linear scales and correct units on both axes; 2. Rates correctly plotted; 3. Line connecting points/(smooth) line of best fit and no extrapolation;	3	 ecf from 05.3 ± 1 mm Allow if 05.3 is left blank Reject a ruled straight line of best fit Ignore sensible/minimal extrapolation If incorrect graph is plotted (e.g. concentration instead of rate) award 1 mark (as long as MP2 and MP3 have both been achieved)

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05.5	Any **three** from: 1. (Steep decrease) and then a less rapid/more gradual decrease; 2. High (initial) rate of reaction/hydrolysis (at 12 hours) as large amount of cellulose/substrate for cellulase; 3. Decreased/rate of reaction as cellulose has been hydrolysed/less substrate/fewer E-S complexes form; 4. (Hydrolysis of) glycosidic bonds;	3 max	 Accept idea of steep decrease initially and then slowing down

05.6	1. Forms long / straight / unbranched chains (of β glucose); 2. Forming (micro) fibrils/(macro) fibrils / (many) hydrogen bonds between chains; 3. Provide rigidity/strength/support;	3	Ignore reference to alpha glucose Reject if any extra wrong function is stated - eg supports the cell and is partially permeable.

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Question	Marking guidance	Mark	Comments
06.1	Any **one** from: 1. Time in buffer solution; 2. Temperature; 3. All pieces taken from the same apple/same variety/type of apple;	1 max	Ignore time if unqualified Ignore volume of buffer solution
06.2	Prevents air/oxygen reaching the apple (tissue) or prevents any (further) change in colour;	1	
06.3	1. Can compare pieces of apple at different pHs to the standard; 2. So that there is more consistency/less subjectivity about the end point/point at which timing is stopped;	2	Accept idea that all have to reach the same shade of brown Accept any reference to the difficulty of judging the degree of 'brownness' Ignore more reliable / accurate / valid / a control unless suitably qualified
06.4	Time taken to turn brown decreases (from pH 4) up to pH 7 **then** increases up to pH 8;	1	Ignore It works fastest at pH7

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06.5	Reduced activity of PPO means less melanin produced **and so** the apple turns brown more slowly/the rate of browning is lower; SC is similar shape to substrate / phenol / oxygen; So SC attaches to active site; SC binds to another site on enzyme and causing a change in the shape of the active site **and so** substrate cannot bind/is no longer complementary/ no E-S complexes form;	3 max	Accept SC is a competitive inhibitor Accept less oxygen can bind / fewer E-S complexes form

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Question	Marking guidance	Mark	Comments
07.1	All/the complete set of DNA/genes/genetic material in a cell/organism/species/person/human/individual;	1	Accept: the haploid set of chromosomes of an organism
07.2	1. DNA that is non coding/does not code for a polypeptide protein;	2 max	
	2. Introns within a gene;		Accept introns within pre-mRNA Accept correct description of an intron Accept non-coding length of DNA within a gene for 2 marks
	3. (Non-coding) multiple repeats (of base sequences) between genes;		Ignore reference to introns here
07.3	0.8 nm;;	2	Any answer with 8 – eg 80, 800 score 1 mark Accept $1.0 \times 10^{9} / 12.5 \times 10^{8} = 8.0$ for 1 mark Accept 8.0/10 = 0.8nm for 2 marks

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07.4	1. DNA strands separate; 2. Each/one strand of old DNA acts as template; 3. New (DNA) stand consists of one old and one new strand; 4. Suitable ref. to H-bonding between bases; 5. New (DNA) chain will incorporate *T(-nucleotides) (from solution); 6. Correct reference to DNA polymerase in joining (adjacent) nucleotides together (to form new strand);	4	Accept idea that hydrogen bonds are broken Accept idea that bonds between the (complementary) bases are broken Accept reference to semi-conservative (replication) Accept correct reference to complementary base pairing Reject any reference to DNA polymerase forming hydrogen bonds between complementary bases

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Question	Marking guidance	Mark	Comments
08.1	**Classification taxon** / ***Phosphaenus hemipterus*** Kingdom: *Animalia* Phylum *Arthropoda* Class *Insecta* Order *Coleoptera* Family *Lampyridae* Genus ***Phosphaenus*** Species ***Hemipterus/ hehipterus***	2	Award 1 mark for each correct column

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08.2	1. (Most common/modal) flash length longest in *P.hemipterus*/shortest in *P. pyralis*; 2. *P. castus* has largest spread of data/flash lengths; 3. Overlap in data between *P. pyralis* and *P.castus*/no overlap in the data beween *P. hemipterus* and any other species; 4. Data normally distributed for all the species;	2 max	Accept correct reference to the number/order of flash lengths between the species Accept largest variety in mean flash lengths/standard deviation Accept some *P.pyralis* and *P. castus* males have the same flash length Accept the number of most common/modal flash length highest in *P.castus*

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08.3	5%;	1	

08.4	1. These males are more likely to accidentally mate/form hybrids with females of a different species;	2	Accept converse – i.e. males less likely to mate with females of their own species
	2. Hybrids are inviable/sterile/non-fertile (so alleles can't be passed on);		Idea that less fertile offspring are produced is insufficient

08.5	1. Smaller groups are placed within larger groups;	2	Accept idea of groups within groups
	2. No overlap between groups;		Accept smaller groups have more features in common / converse Accept idea that features of larger groups are common to all smaller groups Accept idea of groups within group with no overlap for 2 marks

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08.6	1. *Photinus pyralis* and *Photinus castus*; And any **two** from: 2. Idea of more complementary base pairing between closely related/correctly named species; 3. More hydrogen bonds forming; 4. More heat/energy needed to break (the hybridised) strands apart;	3 max	One mark must come from marking point 1 Only two marks from marking points 2,3, 4

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